MOORE INDUSTRIES WORLDWIDE

TFZ

Programmable FOUNDATION Fieldbus™ Temperature Transmitter

June 2013

Description

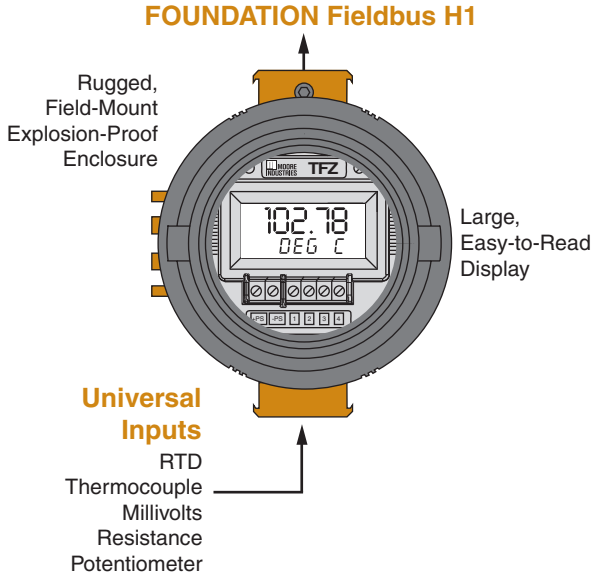
The TFZ Programmable FOUNDATION Fieldbus Temperature Transmitter saves wire and installation costs by allowing up to 32 field devices to be networked onto one, low cost FOUNDATION fieldbus H1 segment.

The loop-powered (2-wire) TFZ offers dozens of input and operation choices. It sets up from the control room over segment wiring using a standard FOUNDATION fieldbus configuration tool to handle 14 RTD types, 9 thermocouple types, as well as direct millivolt and resistance/potentiometer inputs. It converts the input to a FOUNDATION fieldbus H1, two-way digital communication protocol ready for interface with an AMS, DCS or PLC.

Easy-to-Order Temperature Assemblies

One simple model number is all it takes to order our complete temperature assemblies. They include your choice of general location or hazardous area connection head, RTD or T/C sensors, thermowell and process connection.

Figure 1. *Universal, programmable input with FOUNDATION fieldbus digital communication protocol.*



Certifications (see Page 8 for details)

FM APPROVED IECEx ANZEx CE CSA US

*All product names are trademarks of their respective companies.

Fieldbus Foundation MEMBER

Available in a variety of mounting styles, *the TFZ installs on a pipe or surface in the field, or on a DIN-rail and relay track in a multi-unit enclosure or cabinet.*

Features

- **Industry-standard FOUNDATION fieldbus communication.** Featuring a bus connection in accordance with IEC 61158-2 and EN 50170, part 4, the TFZ can be installed in the same segment with all standard FOUNDATION fieldbus devices.

- **Exceptional measurement accuracy.** 20-bit input resolution delivers precise, industry-leading measurements.

- **Easy-to-read, customizable local display.** The large display features alphanumeric characters that can be read easily in the field. It can be customized to display the process variable or the output in user-selectable engineering units.

- **Delivers valuable diagnostic information.** Standard FOUNDATION fieldbus diagnostics provide indication of unwanted process and transmitter conditions.

- **Remote configuration and diagnostics.** The ideal universal plant standard, the TFZ offers versatile input and operation choices, and still can be configured and troubleshooted quickly over the segment, from the control room.

- **Long-term stability.** Provides up to 5 years between scheduled calibrations.

- **Advanced RFI/EMI protection and ambient temperature compensation.** Guard against environmental factors that can quickly degrade measurement accuracy.

TFZ

Programmable FOUNDATION Fieldbus™
Temperature Transmitter

Multidrop Networks Save Wiring Costs

The TFZ is an H1 Basic Device that conforms to the H1 Standard (IEC61158-2, 31.25 kbits/s) and is implemented as a Group 3 (network configurable), Class 31* device.

Acting as a Slave device within a FOUNDATION fieldbus H1 network, up to 32 TFZ transmitters connect in a fieldbus (Figure 2) segment. This means you can save time and money by using a single twisted pair, instead of individual loops, to transmit information from multiple devices.

Function Blocks

Resource Function Block (RB)—Contains diagnostic information, hardware and electronics information (memory, manufacturer identification, device type, software tag) and display configuration parameters.

Temperature Transducer Block (TB)—Contains temperature measurement data, including sensor and terminal temperature. It also includes information about the sensor type, engineering units, linearization, re-ranging, damping, temperature compensation and diagnostics.

Analog Input Block (AI)—Processes measurements from a sensor and makes them available to other function blocks. The output value from the AI block is displayed in engineering units and contains a status indicating the quality of the measurement.

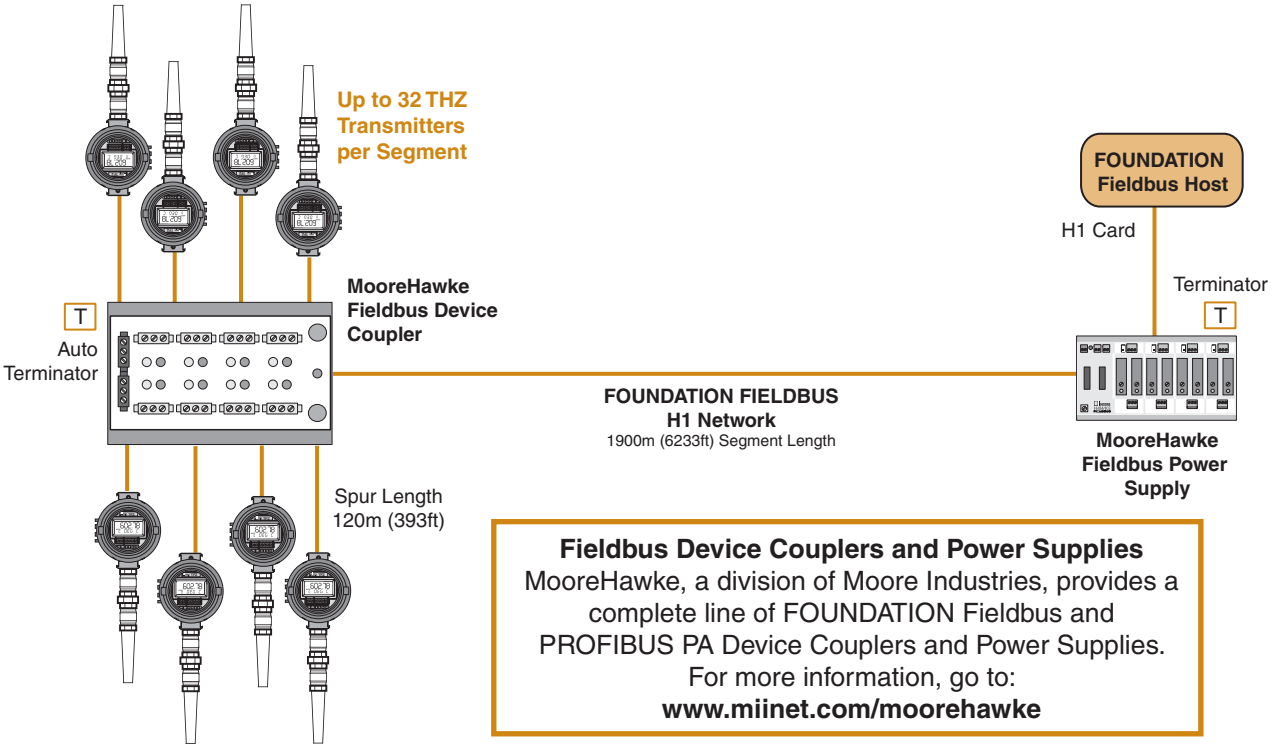
Sets Up from a Hand-Held, DCS or Asset Management System (AMS)

Using its Function Blocks, the TFZ can be remotely programmed in minutes, or interrogated at any time, over the segment using a standard FOUNDATION fieldbus configuration tool. Examples of programmable parameters include:

- **Identification Information—**Product designation/part number, tag, descriptor, installation date, slave address and FOUNDATION fieldbus identification number.
- **Input/Output and Ranges—**Sensor type, span and zero values, lower/upper output ranges and alarm output status.

* Class 31 indicates that the device might publish and/or subscribe data and/or is a client.

Figure 2. *The TFZ transmitter's data and configuration can be viewed, tested and changed from the control room using a HART hand-held configurator, DCS or AMS equipped with a standard FOUNDATION fieldbus configuration tool.*



Fieldbus Device Couplers and Power Supplies
MooreHawke, a division of Moore Industries, provides a complete line of FOUNDATION Fieldbus and PROFIBUS PA Device Couplers and Power Supplies. For more information, go to:
www.miinet.com/moorehawke

- **Set Damping Time—**Eliminate imprecise readings caused by noise and other insignificant process fluctuations by setting a damping time between 1-30 seconds.

- **View Real-Time Process Values—**View the existing process value (in the appropriate engineering unit), and lower and upper range values as a percentage of output span.

Non-Volatile Memory

If power to the transmitter is lost, the unit resumes normal operation with the parameters you've configured upon reapplication of power.

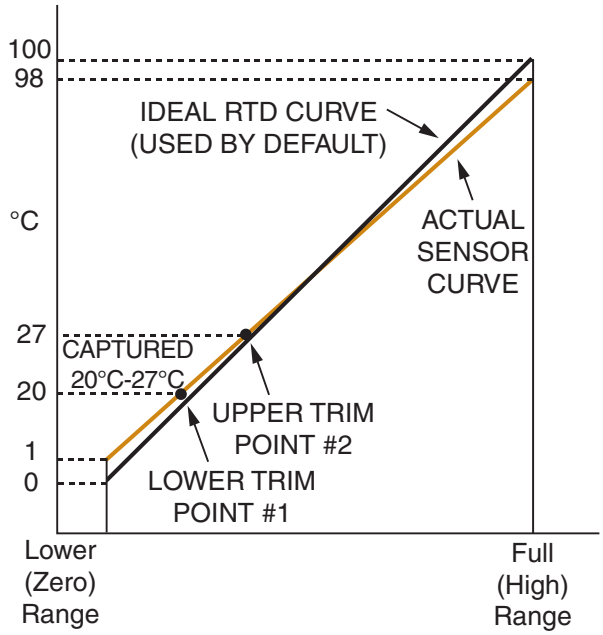
Total Sensor Diagnostics

TFZ transmitters perform continuous sensor diagnostics. This patented Moore Industries feature can save you from costly lost production time and hours of troubleshooting. If the sensor breaks or otherwise stops sending a signal during operation, the transmitter instantly displays the type and location of the error on its display.

Precise Linearization and RJC

The TFZ uses an advanced linearization method to minimize conformance error. Its Reference (Cold) Junction Compensation techniques produce stable readings even in fluctuating ambient temperature conditions. For non-linear inputs, create custom linearization curves using the fieldbus configuration tool.

Figure 3. *The TFZ can be set to measure the segment most critical to the process.*



Trims to Respond to Specific Sensor Curve Segments

Most transmitters zero and span values can be calibrated to measure a specific range within a sensor's overall curve capability. However, for even greater measurement accuracy, our transmitter's trim capabilities go much further.

The TFZ can be trimmed with two data points within the selected zero and span measurement range. This advantage allows a complete process range to be monitored, while placing measurement emphasis on a specific segment of the range most critical to the process.

In Figure 3, the actual sensor curve is used in place of the ideal RTD curve between 20°C and 27°C. This provides incredible precision over a limited portion of the span, while measuring the remainder of the span with the TFZ's usual outstanding accuracy.

TFZ

Programmable FOUNDATION Fieldbus™
Temperature Transmitter

Specifications

Performance

Input Accuracy: Refer to Table 4
Overall Accuracy: The overall accuracy of the unit is the input accuracy. It includes the combined effects of linearity, hysteresis, repeatability and adjustment resolution. It does not include ambient temperature effect. For T/C input, add the RJC error.
Reference Junction Compensation: ±0.45°C (±0.81°F)
Stability: Refer to Table 1
Isolation: 500Vrms between input, output and case continuous, and will withstand a 500Vac dielectric strength test for one minute (with no breakdown)
Step Response Time: 500msec, maximum, 256msec typical from the time an input is applied until the time the corresponding floating point processed variable is available to be read by other FOUNDATION Fieldbus devices
Over-voltage Protection: Input, ±5Vdc peak, maximum
Digital Input Filter: 50/60Hz (user-selectable)

Performance (Continued)

Power Supply Requirement: 9-32Vdc, 10.5mA typical 12.07mA maximum under normal operation; 18mA maximum under fault conditions
Supply Range: 9-32V, Foundation Fieldbus Approved
Load Effect: N/A
T/C Input Impedance: 40Mohms, nominal
Excitation Current: RTD and Ohms, 250 microamps, ±10%
RTD Lead Wire Resistance Maximum: RTD resistance + 2X lead wire resistance <4000 ohms; Recommended lead wire resistance for three wire connections: <35 ohms/wire; 10 ohm copper sensor <5 ohms
Sensor Lead Resistance Effect: 1.0 ohm in reading/ohm of lead resistance for 2-wire sensors; 1.0 ohm in reading/ohm of lead of unbalanced resistance for 3-wire sensors; no effect on 4-wire sensors
Resolution: Input, 20-bit

Display

Type: Top Row, 10mm (0.4 in) high black digits on a reflective background; Bottom Row, 6mm (0.225 in) high digits on a reflective background;

Display (Continued)

Two-digit FOUNDATION Fieldbus address indicator
Format: Two rows of five alphanumeric characters
Decimal Points: Automatically adjusted decimal point with a user selectable maximum up to four places
Range: -99999 to 99999
Minimum Display Span: 1.00

Ambient Temperature

Operating and Storage Range: -40°C to +85°C (-40°F to +185°F)
Relative Humidity: 0-95%, non-condensing
Ambient Temperature Effect: Refer to Table 2
Effect on Reference Junction Compensation: ±0.005°C of input span/°C change of ambient temperature
RFI/EMI Immunity: 20V/m@80-1000MHz, 1kHz AM when tested according to IEC 1000-4-3-1995 with 0.5% of span or less
Startup Time: Performance falls within specification 8 seconds after power is applied
Noise Rejection: Common mode, 100dB@50/60Hz; Normal Mode: Refer to Table 3

Weight 210g (7.4 oz)

Table 1. *Long-Term Stability*

Stability (% of Max. Span)	Input to FOUNDATION Fieldbus H1		
	1 yr	3 yrs	5 yrs
T/C, mV	0.008	0.014	0.019
RTD, Ohm, Pot	0.047	0.081	0.104

Table 2. *Ambient Temperature Effects*

Sensor Type	Digital Accuracy per 1°C (1.8°F) Change in Ambient
RTD	0.003°C
T/C	0.003°C + 0.005% of reading
Millivolt	0.005mV + 0.005% of reading
Ohm	0.002 ohms + 0.005% of reading

Table 3. *Normal Mode Rejection Ratio*

Sensor Type		Max. p-p Voltage Injection for 70dB at 50/60Hz
T/C: J, K, N, C, E		150mV
T/C: T, R, S, B		80mV
Pt RTD: 100, 200, 300 ohms		250mV
Pt RTD: 400, 500, 1000 ohms		1V
Ni: 120 ohms		500mV
Cu: 9.03 ohms		100mV
Resistance	**mV**	
1-4kohms	250-1000	1V
0.25-1kohms	62.5-250	250mV
0.125-0.25kohms	31.25-62.5	100mV

Table 4. *Input and Accuracy*

Input	Type	α	Ohms	Conformance Range	Minimum Span	Input Accuracy	Maximum Range	Sensor-to-Transmitter Matching
	Platinum	0.003850	100	-200 to 850°C -328 to 1562°F	10°C (18°F)	±0.1°C (±0.18°F)	-240 to 960°C -400 to 1760°F	Up to ±0.014°C (±0.025°F) system accuracy*.
			200					
			300					
			400					
			500					
			1000					
		0.003902	100	-100 to 650°C -148 to 1202°F			-150 to 720°C -238 to 1328°F	
			200					
			400					
			500					
			1000					
		0.003916	100	-200 to 510°C -328 to 950°F			-240 to 580°C -400 to 1076°F	
	Nickel	0.00672	120	-80 to 320°C -112 to 608°F			-100 to 360°C -148 to 680°F	
	Copper	0.00427	9.035	-50 to 250°C -58 to 482°F	100°C	±0.85°C (±1.53°F)	-65 to 280°C -85 to 536°F	
Ohms	Direct Resistance	n/a	0-4000 ohms	0-4000 ohms	10 ohms	±0.4 ohms	0-4095 ohms	
	Potentiometer		125, 250, 500, 1k, 2k, 4k ohms	0-100%	10%	±0.1%	0-100%	
	J	n/a	n/a	-180 to 760°C -292 to 1400°F	35°C 63°F	±0.25°C (±0.45°F)	-210 to 770°C -346 to 1418°F	
	K	n/a	n/a	-150 to 1370°C -238 to 2498°F	40°C 72°F	±0.3°C (±0.54°F)	-270 to 1390°C -454 to 2534°F	
	E	n/a	n/a	-170 to 1000°C -274 to 1832°F	35°C 63°F	±0.2°C (±0.36°F)	-270 to 1013°C -454 to 1855.4°F	
	T	n/a	n/a	-170 to 400°C -274 to 752°F	35°C 63°F	±0.25°C (±0.45°F)	-270 to 407°C -454 to 764.6°F	
	R	n/a	n/a	0 to 1760°C 32 to 3200°F	50°C 90°F	±0.55°C (±0.99°F)	-50 to 1786°C -58 to 3246.8°F	
	S	n/a	n/a	0 to 1760°C 32 to 3200°F	50°C 90°F	±0.55°C (±0.99°F)	-50 to 1786°C -58 to 3246.8°F	
	B	n/a	n/a	400 to 1820°C 752 to 3308°F	75°C 135°F	±0.75°C (±1.35°F)	200 to 1836°C 392 to 3336.8°F	
	N	n/a	n/a	-130 to 1300°C -202 to 2372°F	45°C 81°F	±0.4°C (±0.72°F)	-270 to 1316°C -454 to 2400.8°F	
	C	n/a	n/a	0 to 2300°C 32 to 4172°F	100°C 180°F	±0.8°C (±1.44°F)	0 to 2338°C 32 to 4240.4°F	
Millivolts	DC	n/a	n/a	-50 to 1000mV	4mV	15 microvolts	-50 to 1000mV	

*High-accuracy measurements are achieved by using a 4-wire, 1000 ohm platinum RTD with a span of 100°F (50°F minimum) calibrated in our

TFZ

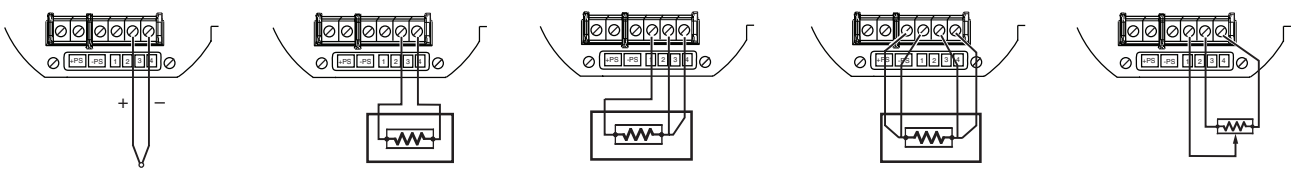
Programmable FOUNDATION Fieldbus™
Temperature Transmitter

Ordering Information

Unit	Input	Output	Power	Options	Housing
TFZ Programmable FOUNDATION Fieldbus Transmitter	**TPRG** Programs to accept RTD, T/C, ohm and mV inputs	**H1** FOUNDATION Fieldbus H1	**9-32DC** for General Location and Non-Incendive Applications **9-30DC** for Intrinsically-Safe Applications **9-24DC** for FISCO Applications (10.5mA typical; 12.07mA maximum under normal operation; 18mA maximum under fault condition)	**-VTD** Factory calibration with NIST traceable test report **-VTB*** Factory calibration using Sensor-to-Transmitter Trimming with NIST traceable test report * The -VTB option applies to units ordered with sensors and complete temperature assemblies only	**HP** Hockey puck housing and spring clips **DN** Snap-in mounting for HP case on TS-32 DIN-rail **FL** Mounting flanges on HP for relay track or screw mounting **FLD** Mounting flanges on HP for 3½" relay track mounting **BH2NG** Explosion-Proof enclosure with two 1/2-inch NPT entry ports and a glass cover **BH2TG** Explosion-Proof enclosure with two 3/4-inch NPT entry ports and a glass cover **BH2MG** Explosion-Proof enclosure with two M20 x 1.5 NPT entry ports and a glass cover **BH3NG** Explosion-Proof enclosure with three 1/2-inch NPT entry ports **BH3TG** Explosion-Proof enclosure with two 3/4-inch side-entry NPT ports, one 1/2" bottom port, and a glass cover **BH3MG** Explosion-Proof enclosure with two, M20 x 1.5 side-entry ports, one 1/2" bottom-entry port, and a glass cover **D2LC** 2-Hub, low base, clear cover, IP66/NEMA 4X enclosure **SB2NG** 2-Hub, Explosion-Proof enclosure with two, ½-inch NPT entry ports and a glass cover **SB2MG** 2-Hub, Explosion-Proof enclosure with two, M20 x 1.5 entry ports and a glass cover **A** suffix with BH or SB indicates ANZEx/TestSafe (Ex d) Flame-Proof approvals; 2" pipe-mount kit is included (i.e., BH2MG**A** or SB2MG**A**) **E** suffix with BH or SB indicates ATEX Flame-Proof enclosures; 2" pipe-mount kit is included (i.e., BH2MG**E,** SB2NG**E**) **P** suffix indicates enclosure is equipped with 2" pipe-mount hardware kit (i.e., BH2NG**P**)

To order, specify: Unit / Input / Output / Power / Options [Housing]
Model number example: TFZ / TPRG / H1 / 9-32DC [BH2NG]

Figure 4. *Sensor/input connections*



Thermocouple and Millivolt Input

2-Wire RTD or Decade Resistance Box

3-Wire RTD or Decade Resistance Box

4-Wire RTD or Decade Resistance Box

Potentiometer Input

Figure 5. *Dimensions for TFZ in HP (hockey-puck) housing with flanges (FL)*

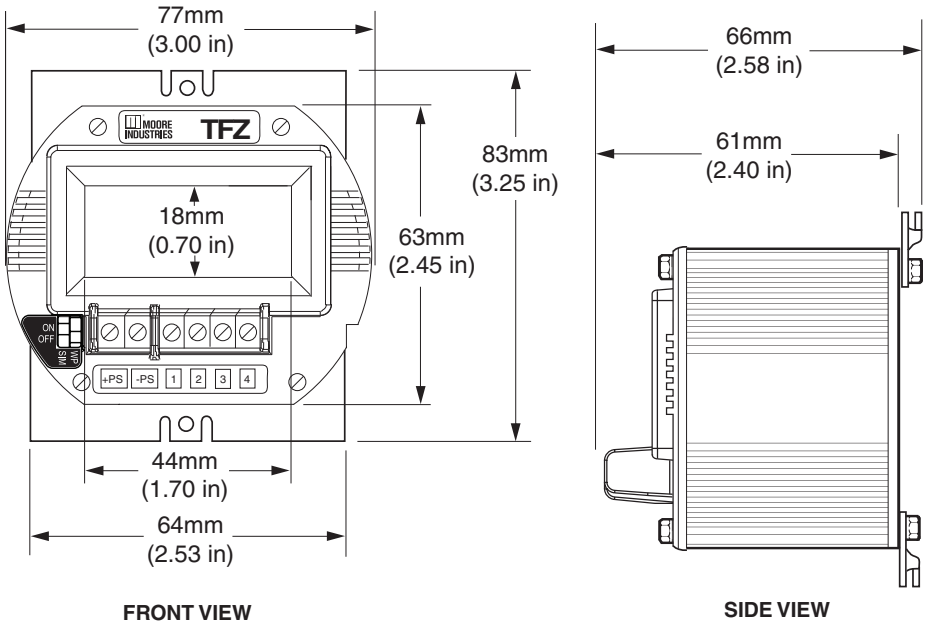


Figure 6. *Dimensions for the TFZ in BH field-mount enclosure*

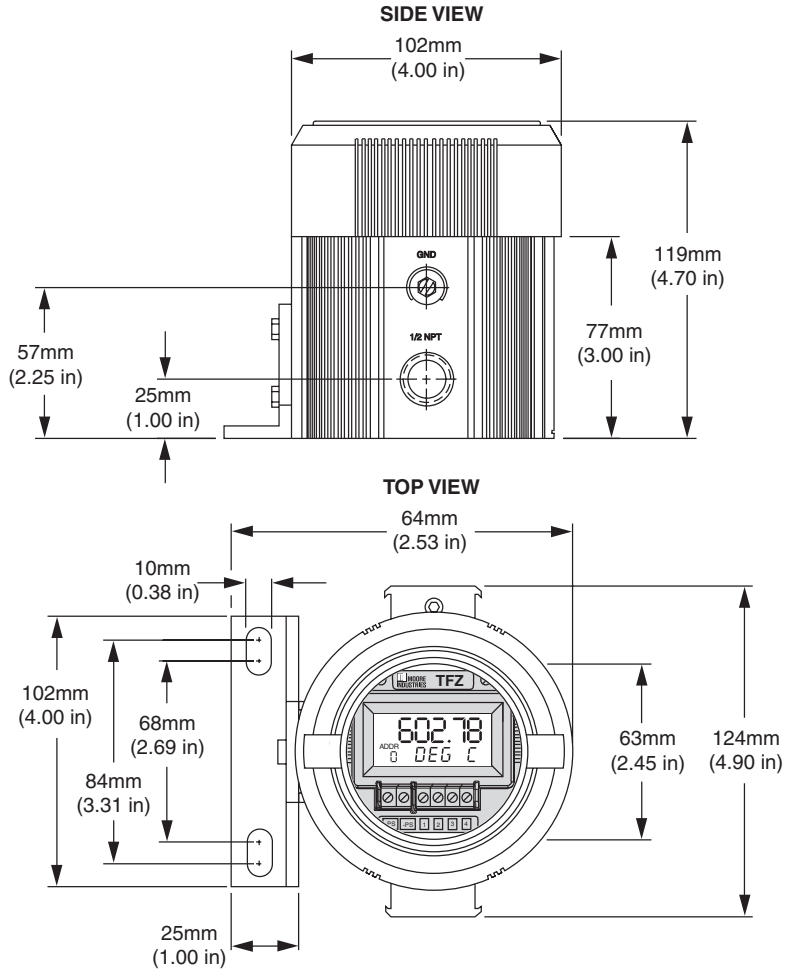
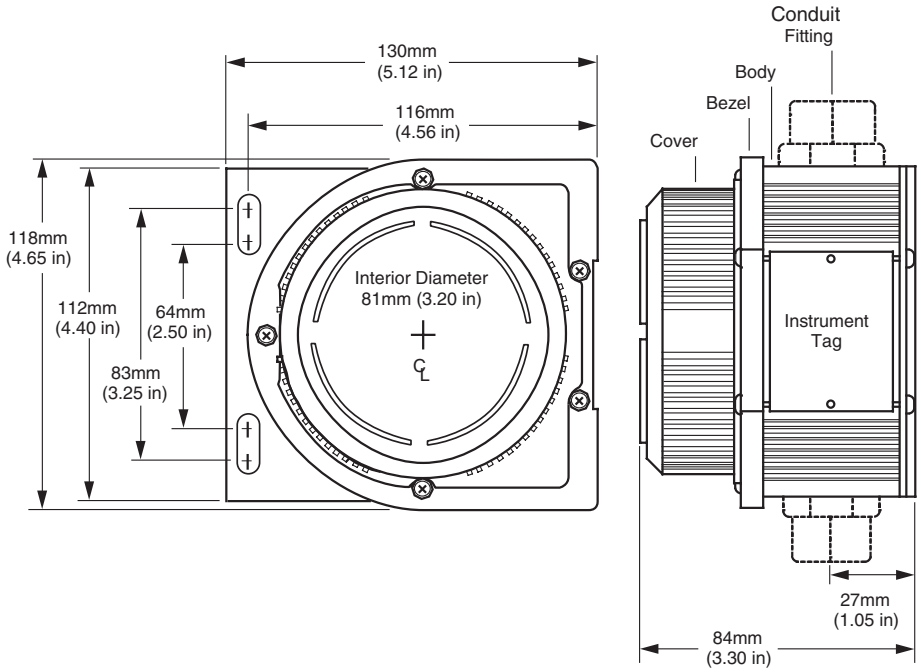


Figure 7. *Dimensions for TFZ in D-BOX field-mount enclosure*



Certifications

TFZ

Factory Mutual (US/Canada)
Intrinsically-Safe & Non-Incendive
Class I, Divisions 1 & 2, Groups A, B, C & D
Class I, Zone 0, AEx ia IIC T4

ATEX Directive 94/9/EC:
Intrinsically-Safe & Type "n"
II 1G Ex ia IIC, T4@85°C max
II 3G Ex nA IIC, T4@85°C max

IECEx:
Intrisically-Safe & Type "n"
Ex ia IIC T4 Ga
Ex nA nL IIC T4 GA

CE Conformant
EMC Directive 2004/108/EC – EN 61326

TFZ-HP in BH/SB2 Housing

Factory Mutual:
Explosion-Proof & Dust-Ignition Proof
Class I, Division 1, Groups A*, B, C & D
Class II & III, Division 1, Groups E, F & G
Environmental Protection: Type 4X &IP66
T6 @60°C Maximum Operating Ambient
* For Group A applications, seal all conduits within 18"

Canadian Standards Association
Explosion-Proof
Class I, Division 1, Groups A*, B, C & D
Class II & III, Division 1, Groups E, F & G
Environmental Protection: Type 4X &IP66
T6 @60°C Maximum Operating Ambient
* For Group A applications, seal all conduits within 18"

ATEX Directive 94/9/EC:
Explosion/Flame-Proof
II 2 G Ex d IIC T6 (Tamb 60°C)
II 2 D Ex tD A21 IP66 T85°C

ANZEx (TestSafe):
Explosion/Flame-Proof
Ex d IIC T6 (Tamb 60°C)

WORLDWIDE • www.miinet.com

MOORE INDUSTRIES

United States • info@miinet.com
Tel: (818) 894-7111 • FAX: (818) 891-2816

Australia • sales@mooreind.com.au
Tel: (02) 8536-7200 • FAX: (02) 9525-7296

Belgium • info@mooreind.be
Tel: 03/448.10.18 • FAX: 03/440.17.97

The Netherlands • sales@mooreind.nl
Tel: (0)344-617971 • FAX: (0)344-615920

China • sales@mooreind.sh.cn
Tel: 86-21-62491499 • FAX: 86-21-62490635

United Kingdom • sales@mooreind.com
Tel: 01293 514488 • FAX: 01293 536852